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DEMONSTRATION GUIDE FOR PREVENTION OF ELECTRIC SHOCK INJURY

Bureau of Community Environmental Management
Rockville, Maryland

1969

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DEMONSTRATION GUIDE FOR PREVENTION OF ELECTRIC SHOCK INJURY

Details of illustrations in this document may be better studied on microfiche

U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE

Public Health Service

Consumer Protection and Environmental Health Service

ENVIRONMENTAL CONTROL ADMINISTRATION

Bureau of Community Environmental Management

1969

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INTRODUCTION

Each year about a thousand persons in the United States are killed by electric current. The number of nonfatal injuries from electric current that result in burns, paralysis, and heart fibrillation - in addition to those injuries indirectly related to current flow - is not available. Undoubtedly, the potential and actual injury experienced from misuse of electric current far exceeds the national figures for reported deaths. Accidents associated with electric current, however, are in a category to which the triad of prevention may be applied with relative ease.

This guide contains suggestions for the development and safe use of an effective demonstration tool intended to be used as part of a total program for prevention of electric shock injury. In itself, the demonstration unit is not a program.

The treatment of the subject is not intended to be definitive or all inclusive. It is flexible and permits the addition of new developments to meet the local needs and interests of the community.

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DEMONSTRATION GUIDE FOR PREVENTION OF ELECTRIC SHOCK INJURY

SUGGESTED USE OF VISUAL AIDS AND DEMONSTRATION PROCEDURES

(a) A model home designed to demonstrate basic properties of electricity and fundamentals of electric safety.

(b) A suggested script for use in a live 45- to 60-minute demonstration with lecture, using the model home in conjunction with selected transparencies (numbers 1-12) or slides (numbers 1-37).

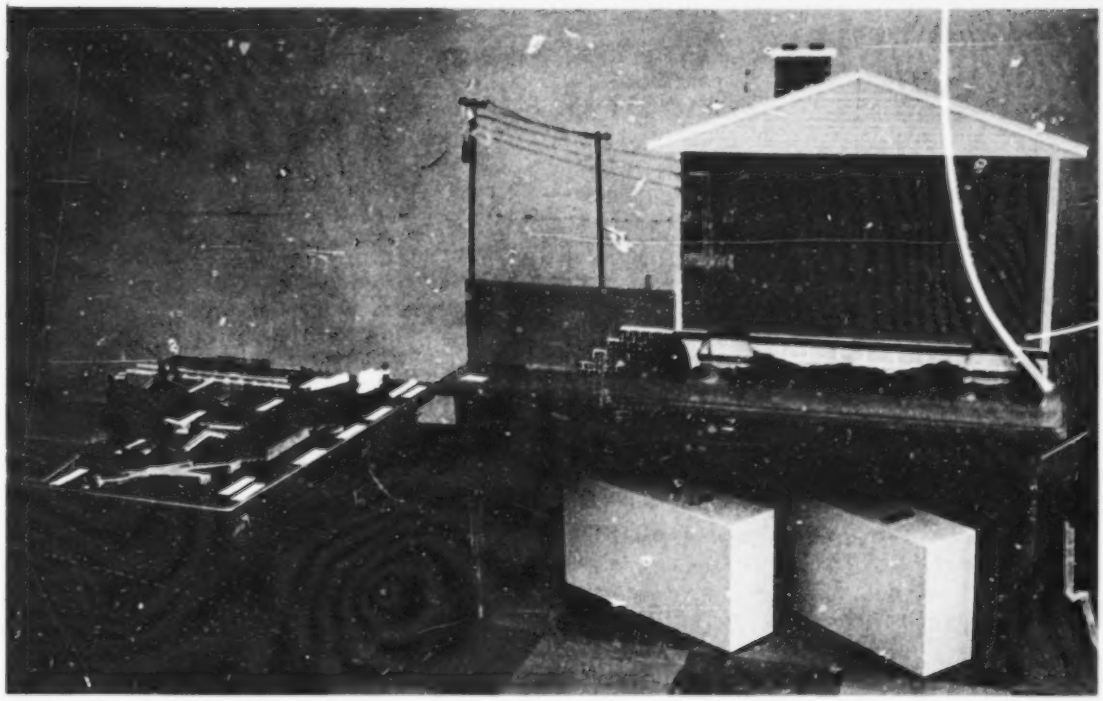
(c) An instructor's guide and a set of transparencies for overhead projection for use in a 30-minute lecture and visual presentation (numbers 1-22). Demonstration kit not needed for presentation in (c) and (d).

(d) An instructor's guide and a set of 2" X 2" slides for use where an overhead projector is not available or where slides are preferred.

(e) Suggested script suitable for use with either type of visual aid.

(f) A manual describing the demonstration kit including suggestions for its use, a listing of visual aids, reference materials, suggested scripts, and technical background material.

CONTENTS OF DEMONSTRATION KIT



SUGGESTED PROCEDURE

The purpose of this demonstration is to illustrate and explain basic facts particularly applicable to electricity, electrical systems, and electrical cords and appliances in the home. Understanding these facts is essential to the prevention of injuries associated with the misuse of electrical current.

The preferred method of presenting this educational program is to show the transparencies (numbers 1-12) on an overhead projector or slides 1-37, followed by the demonstration. It also may be presented by showing the transparencies 1-22 or slides 1-59 without the demonstration.

Information concerning the loan or purchase of a transparency set, slides, or demonstration kit may be obtained by contacting your health department or the U.S. Department of Health, Education, and Welfare, Public Health Service, Consumer Protection and Environmental Health Service, Environmental Control Administration, Bureau of Community Environmental Management, 222 East Central Parkway, Cincinnati, Ohio 45202.

In order to learn quickly how to make effective use of this educational tool, the demonstrator is urged to follow these suggestions:

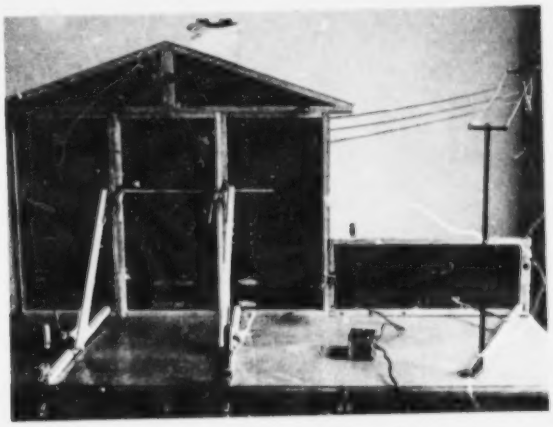
1. Become familiar with the Facts About Electricity beginning on page 7. Know what electricity is, its relationship to man, shock prevention concepts, and rescue and emergency care procedures.

2. Rely upon the scripts until familiar with the demonstration, including the slide or transparency presentation. The script for the demonstration kit begins on page 25, and the visual presentation on page 15.

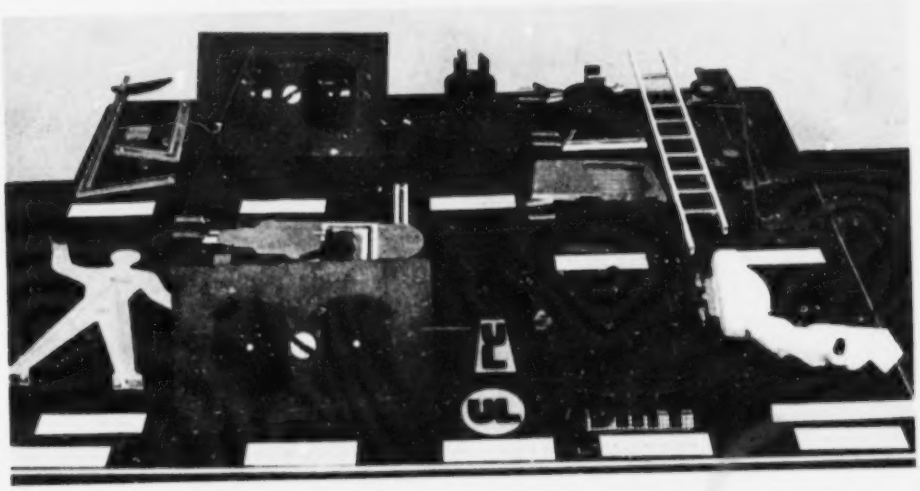
3. Place the equipment on a table within easy reach, and in the manner shown and described on page 6.

4. Assemble the house and accessory items on a suitable table, as shown in the photographs below.

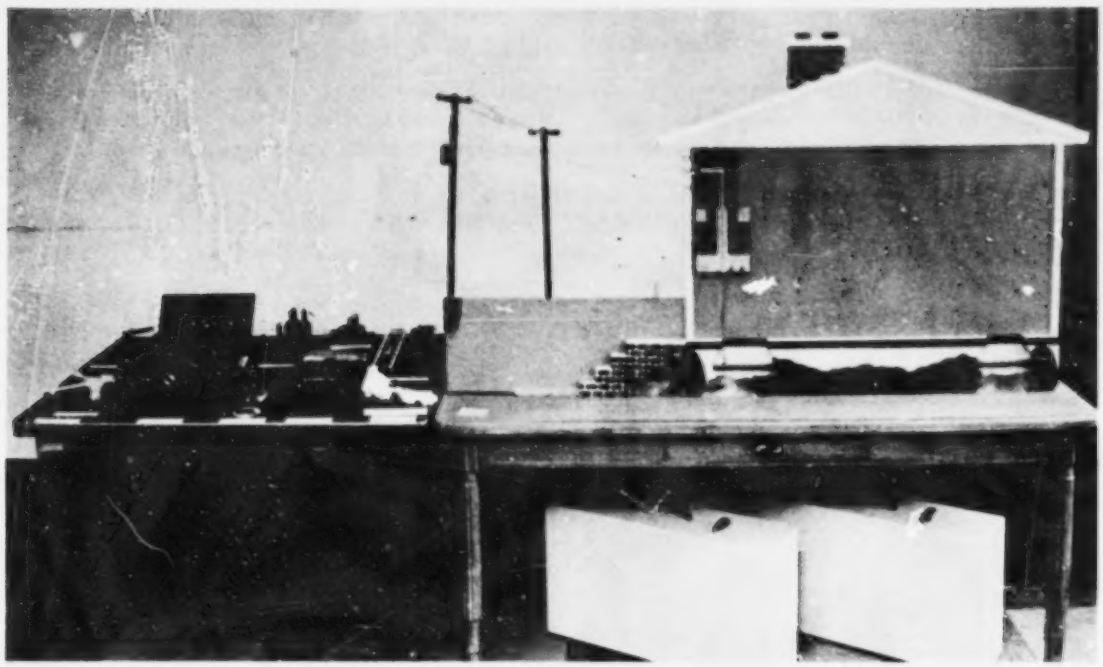
Front View (Table I)



Rear View (Table I)



Top View (Accessory items) (Table II)



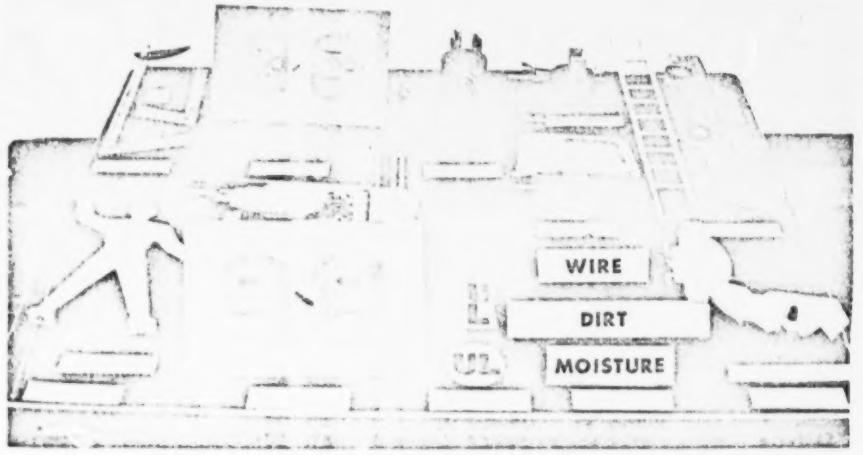
Front View
(Tables I and II combined)

5. After making the required electrical connections, turn the transformer switch to ON position and, using circuit tester, check for electrical continuity before beginning demonstration. This can be done by placing one prong on wire leading from fuse and the other prong to the grounded service box. The light should glow.

DEMONSTRATION LAYOUT (TABLE II)

• Replacement fuses • Wall outlet ground wire • Appliance cord grounding wire	• Circuit tester (12 volt) • Circuit tester (120 volt) • Wall outlet (oversized – 3-hole)	• Adaptor • 3-prong plug	• 2-wire toaster cord • 2-prong plug (crossed) • Knife • 2-wire toaster cord • Toaster cutout	• Automobile • Kite • Ladder
Part 7 Personal protection through equipment ground	Part 8 Checking an outlet for ground	Part 9 Grounding of portable appliances	Part 10 Equipment not in use can be a hazard	Part 11 Shock hazards outside the house
• Man • Pointer stick	• 2-wire appliance cord • Drill cutout • Wall outlet (working model) • Wall outlet (oversized – 2-hole)	• UL (cord) label • UL (appliance) label	• Shorting block • Wire sign • Dirt sign • Moisture sign	• Sink • Tissue paper • Dropper bottle (salt water) • Grounded metal floor
Parts 1 & 2 Furthering our understanding of electricity	Part 3 Our electrical system and appliances	Part 4 Underwriters' Lab. Tabels	Part 5 Proper use and maintenance of electrical equipment	Part 6 Electrically unsafe equipment and you

The script for this demonstration consists of 11 different parts or subtopics. It is suggested that the materials be laid out in the order in which they are needed to complete each part, as has been done in the picture and corresponding chart on this page. Obviously, certain pieces of material such as the plastic man, will have to be used in more than one part of the program.



DEMONSTRATION LAYOUT (TABLE I)

• Replacement fuses • Wall outlet ground wire • Appliance cord grounding wire	• Circuit tester (12 volt) • Circuit tester (120 volt) • Wall outlet (oversized – 3-hole)	• Adaptor • 3-prong plug	• 2-wire toaster cord • 2-prong plug (crossed) • Knife • 2-wire toaster cord • Toaster cutout	• A • K • L
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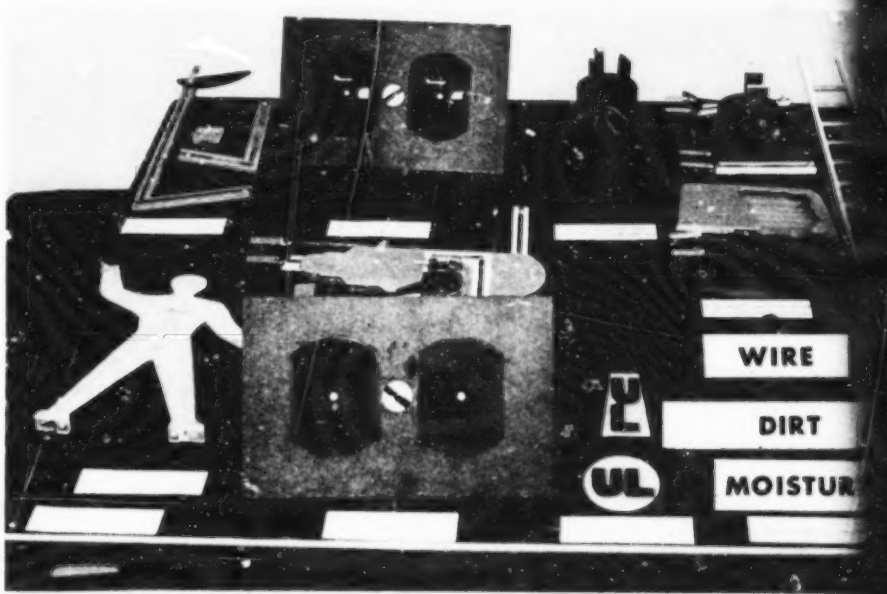

DEMONSTRATION LAYOUT (TABLE I)

• Circuit tester (12 volt) • Circuit tester (120 volt) • Wall outlet (oversized – 3-hole)	• Adaptor • 3-prong plug	• 2-wire toaster cord • 2-prong plug (crossed) • Knife • 2-wire toaster cord • Toaster cutout	• Automobile • Kite • Ladder
Part 8 Checking an outlet for ground	Part 9 Grounding of portable appliances	Part 10 Equipment not in use can be a hazard	Part 11 Shock hazards outside the house
• 2-wire appliance cord • Drill cutout • Wall outlet (working model) • Wall outlet (oversized – 2-hole)	• UL (cord) label • UL (appliance) label	• Shorting block • Wire sign • Dirt sign • Moisture sign	• Sink • Tissue paper • Dropper bottle (salt water) • Grounded metal floor
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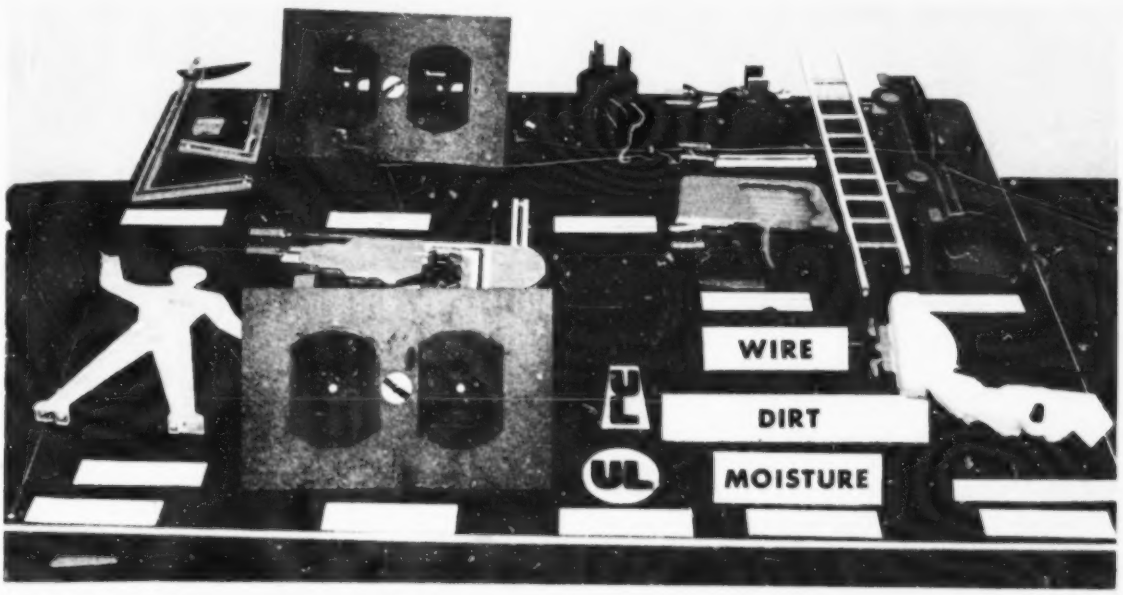
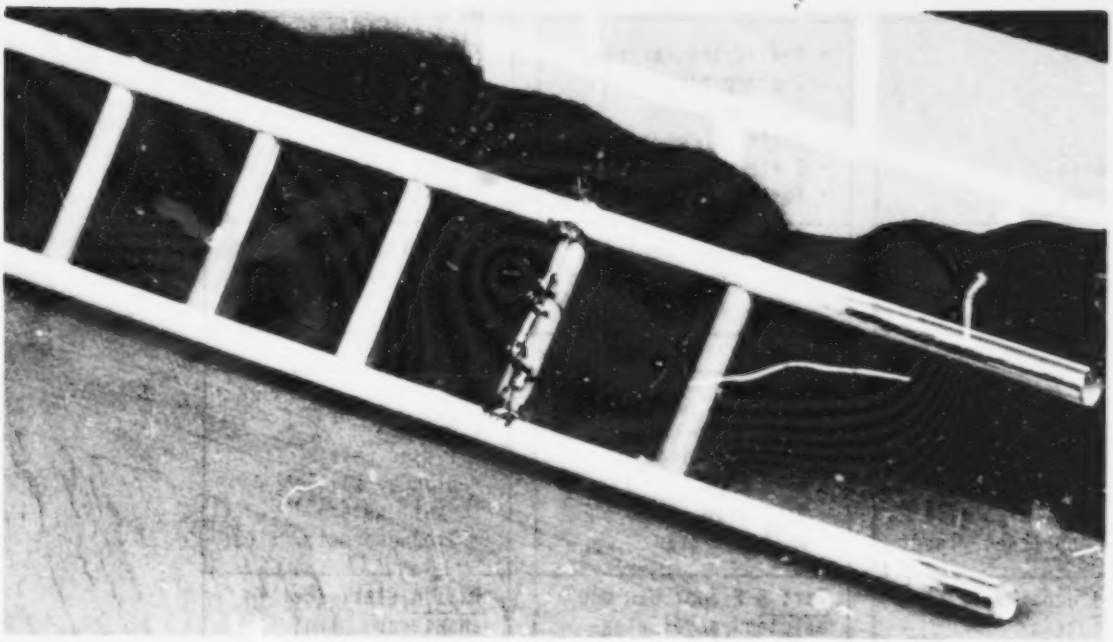


6. Prepare ladder explosive (cigarette) load as shown.



7. If the transparencies or slides are to be used, make sure they are in the proper sequence. The script beginning on page 15 may serve as a guide for arranging them.

FACTS ABOUT ELECTRICITY*

A. Basic Information about Electricity

What is Electricity?

Electricity is a form of energy, just as heat, light, and sound are forms of energy. It can neither be created nor destroyed, at least not by ordinary means. Electricity is contained in and derived from all matter that occupies space and has weight. Electricity, then, is present in those things that surround us. All matter contains tiny particles called atoms. Each atom has its own protons, neutrons, and electrons. Protons and neutrons stick close together, whereas electrons can be ''moved'' quite easily from one atom to another. The movement of electrons from one atom to the next is what we call electricity.

Generators and chemical action most often provide the difference in voltage (pressure or potential) to cause electricity (electrons) to flow and become useful.

How Does Electricity Travel?

Electricity travels only in a closed or looped circuit. From the generator, the electricity flows through wires (conductors) to transformers where the voltage (pressure) is increased (or reduced). From the transformer, it flows into the building or dwelling where it will do useful work and, then, back to the earth through wire or other conductive materials. Generators and transformers have direct connections to the earth, and electrical current will use these paths to complete a circuit if its normal path or return (through wires) is broken, provided it can get to earth.

B. Electricity and You

How Does Shock Occur?

Shock and related injuries may occur when the body becomes a part of this circuit or closed loop. You may become a part of an existing circuit by touching both wires of an energized circuit, or you may create an unintentional circuit back to earth by touching an energized wire or

*The basic information sheets are primarily for use by the demonstrator. They may be helpful when answering questions relating to information not contained in the two scripts.

an energized conductive object while your body is directly or indirectly in contact with the earth.

What Determines the Severity of the Shock?

The severity of the shock received as a result of an accidental contact with an electric circuit depends upon a number of factors:

(1) The amount (rate of current flow measured in amperes) and duration (exposure time) of the current flow.

(2) Part of the body through which current flows (current flowing from one finger to another of the same hand would *not* pass through vital organs and, therefore, would not be fatal, although a burn might result).

(3) Resistance offered by the body. As the skin becomes progressively moist, its resistance decreases and will allow more current to pass through it.

(4) Type of circuit with which contact is made. The pulsations of the 60-cycle, 120-volt alternating currents (A.C.) normally found in most homes in the United States are more pronounced in producing a physiological response than are equivalent uninterrupted direct (D.C.) currents.

Also, at much higher frequencies than experienced in the home (above 60 cycles) the body does not experience any sensation to current flow except heat. One of the present-day medical uses of electricity in which this principle is applied is in diathermy apparatus.

(5) Other factors that may affect the degree of shock include:

(a) phase of the heart cycle when shock occurs (applies to monetary contact);

(b) Age, size, and physical condition of person.

What are the Physiological Effects of Varying Amounts of Current Flow?

The physiological effects of electric shock result from passage of the electric current through the body. There are no precise limits which determine the exact injury from any given amount of current flow (measured in amperes). The following chart, however, gives approximate measurements of injury related to amperage: (See chart on next page.)

What is Voltage and its Relationship to the Shock Hazard?

Voltage is the difference in electrical pressure between two substances and/or objects. Earth is considered as having zero voltage.

Voltage is what provides electricity with the ability to overcome the resistance presented by materials and substances through which electric-

Amount of current, in milliamperes* (1 ampere = 1,000 milliamperes)	= Fraction of total potential current flow from a typical 15-ampere wall outlet	= Physiological response
Less than ½	1/30,000	No sensation
½ to 2	1/30,000 - 1/7,500	Threshold of perception
2 to 10	1/7,500 - 1/1,500	Muscular contraction (mild to strong)
5 to 25	1/3,000 - 1/600	Painful shock, inability to let go
Over 25	1/600	Violent muscular contraction
50 to 200	1/300 - 1/75	Heart convulsions, death (fibrillation)
Over 100	1/150	Paralysis of breathing, burns

*For comparison, a 100-watt light bulb consumes about 1,000 milliamperes.

ity may tend to flow. Resistance to current flow varies greatly from item to item and is measured in ohms.

Because of varying physiological makeup of the body, it is difficult to establish a definite voltage sufficient to overcome man's natural skin resistance to the extent that a shock hazard exists. A value of 30 volts *alternating current*, however, has received wide acceptance for indoor application (outdoor application may be as low as 12 volts). When the voltage is increased to the 120-240 volts used in most homes, a definite shock hazard exists.

What is the Relationship of the Variables: Ampere, Volt, and Ohm?

Three basic terms are related to each other as expressed in Ohm's Law:

$$\text{Quantity (amperes)} = \frac{\text{Pressure (volts)}}{\text{Resistance (ohms)}}$$

Examples of the number of ohms resistance are:

Dry wood - 100,000 to 1,000,000 ohms per centimeter (1 inch = 2.54 centimeters)

Wet wood - 1,000 to 50,000 ohms per centimeter

#10 Copper wire - 1 ohm per 1,000 feet

Human Body

Dry skin - 100,000 to 500,000 ohms.

Perspiring - down to 1,000 ohms.

In water - down to 150 ohms.

Example (1). Suppose a person used an electrical appliance with a two-wire cord. The appliance is plugged into a 110-120 volt house line. While the appliance is in use, a current path is accidentally created, causing the frame to become energized. The appliance may still function properly but is "electrically unsafe." The amperes that can flow through the body are:

$$\frac{110 \text{ (volts)}}{100{,}000 \text{ (ohms)}} = .0011 \text{ amperes or}$$

1.1 milliamperes = threshold of perception

Example (2). But, if the person were perspiring, as we do at all times to a varying degree, the amount of current in amperes that could flow through his body, using the same appliance, is:

$$\frac{110 \text{ (volts)}}{1{,}000 \text{ (ohms)}} = .11 \text{ amperes or}$$

110 milliamperes = Enough to cause death (refer to injury measurements chart)

Example (3). When the same appliance is used by a person standing in a body of water, or in the bath tub or shower, the potential current flow is:

$$\frac{110 \text{ (volts)}}{150 \text{ (ohms)}} = .73 \text{ amperes or}$$

730 milliamperes = paralysis of breathing, burns.

C. Shock Prevention Concepts

What Causes Tools to Become "Hot"?

The exposed metal "conductive" frame of electrical appliances, and especially portable tools, may become energized when interior insulation fails or when another energized wire or electrical conductor is contacted.

Current may energize the exterior parts by leaking through the interior (primary) insulation. Depending upon the intended use of the item, a *very* small amount of leakage is permitted by Underwriters' Laboratories, even in *new* electrical tools and appliances. With normal use, and especially with improper use, the insulation tends to deteriorate so that leakage may gradually increase, becoming great enough to cause one to drop the tool. Under certain conditions, the leakage may become fatal.

Current may travel over and under internal insulation due to carbon, metallic particles, or moisture buildup. It is essential to clean periodically all electrical items that have moving parts (motors).

Also, insulation of component parts may fail because of cracking or fraying from age and wires may become pinched between halves of the exterior frame. Improper repair or replacement of internal wiring may allow a strand of wire to touch noncurrent-carrying metal parts of the exterior. These and other failures can cause the frame of the electrical item to become energized.

The metal frame also may become energized by contacting another energized conductor; for example, in accidentally drilling or sawing into a wall partition or floor containing live conductors, or cutting into the power cord of the tool.

How Can You Protect Yourself From Shock?

When using electrical appliances or tools, you may protect yourself by:

(1) using (when applicable) appliances that are properly and effectively grounded through the use of a third wire;

(2) using "double-insulated" tools with secondary insulation, or those with a plastic (non-conductive) housing;

(3) wearing protective clothing or equipment: rubber gloves (designed for use with electricity) rubber floor mats, etc;

(4) avoiding simultaneous contact with any potentially energized conductor and ground.

What are the Advantages and Disadvantages of Equipment Grounding?

Advantages:

(1) Grounding (third wire) requires no extra equipment.

(2) Protection is provided from shock hazards within and outside.

(3) The method is recognized as an effective and safe protection from shock.

Disadvantages (Limitations):

(1) It may not offer adequate protection to a person using an electrical tool while perspiring or when he is on wet ground, and it will not protect him if he is in water.

(2) It will not be effective when the grounding prong has been clipped off or bent out of position; or when used with an adaptor where the pig tail is not properly connected to a grounded circuit.

(3) There is the possibility that the ground is ineffective because of the substitution of a section of plastic pipe for conductive metal pipe.

(4) A meter may disrupt the continuity with earth.

(5) The face plate and receptacle box may not be grounded, particularly in older homes.

(6) Sometimes, even a three-prong receptacle is not grounded because of improper or hasty installation. An individual can check for ground continuity by using a circuit tester, but only a qualified electrician with the proper equipment can determine the effectiveness of a ground.

It should be noted that the use of ungrounded *defective* electrical equipment in the presence of grounded equipment presents a shock hazard because touching the metal frame of a grounded tool is the same as touching any other ground. Also, the accidental reversal of "green" grounding wire and "black" energized wire to the plug on the appliance cord will energize the conductive frame.

Should Everything Be Grounded?

When electrical equipment is used where no ground is present, it may not be necessary to consider equipment grounding. Priority always should be given to portable power tools, appliances, and other items used in the vicinity of metal pipes and metal duct work; in the garage or basement; on the patio or any place where you stand on a concrete floor that is in contact with the earth; or when you stand on earth itself. Portable power tools, however, such as electric drills, hedge trimmers, etc., *should* be grounded wherever they are used.

There is an exception to the general rule that most portable electrical equipment should be grounded. Under no circumstance should you ground items with an accessible open-coil heating element. The accessible open-coil heating element, such as that found in toasters, some broilers, and portable electric heaters, is actually an energized wire. Grounding increases the hazard. For example, if you touch the energized heating element of a *grounded* toaster with a metal instrument such as a knife, while, at the same time, the other hand holds or steadies the metal frame, a circuit is completed from hand to hand. The shock hazard with an ungrounded toaster, however, would result only from contact with the energized element while simultaneously contacting a ground within reaching distance of the appliance in use. The ungrounded toaster, therefore, presents the lesser hazard. The hazard is eliminated in either case only when the toaster is disconnected from the energized outlet.

What About Double Insulation?

Double insulated tools are a relatively new development. In addition to the normal (primary) insulation on electric tools, a secondary insulation system is provided to protect the user from stray current should a failure occur in the functional (primary) insulation system. The secondary insulation may be located inside the frame, or the frame itself may be made of a nonconductive material. Tools having "double insulation" are so marked. To conform with present Underwriters' Laboratories standards (UL), these tools do not have a third (ground) wire.

Advantages:

(1) The user does not need to know about grounding.

(2) No special or extra equipment, such as an adaptor or three-prong plug, is needed.

(3) The outlet need not be grounded.

Disadvantages (Limitations):

(1) If both insulation systems fail (and it can happen), you may get a shock if you touch an exposed metal part while in contact with the ground.

(2) As with grounded tools, double insulation tools are not completely safe in moist areas or in water.

(3) They are more expensive.

(4) They are not readily available in all lines of equipment. Prevention is still the most reliable means of avoiding injury associated with electric current.

D. Removal and Emergency Care of Victim

Breaking contact with the electrical circuit should be done as promptly as possible. A dry stick, dry rope, dry coat, newspaper, or other dry nonconductor may be used to free the victim where immediate de-energizing of the conductor is not possible.

Mouth-to-mouth artificial respiration is a great life-saving measure in electric shock, gas poisoning, drowning, and in other emergencies that result in the cessation of breathing. To be effective, it must be applied immediately after rescue and should be continued until normal breathing has been restored, or until death is certain.

The unconscious person often needs to be protected from further strain on his vitality, which already is weakened. As far as possible, keep him covered and warm both during and after resuscitation. Do not permit the patient to exert himself. If it should be necessary to move him, keep him lying down.

Never give liquids to an unconscious person. They may choke him. To avoid strain on the heart, when the victim revives, he should be kept lying down and not allowed to stand or sit. Seek medical assistance as soon as possible.

Script I

PRESENTATION ON PREVENTION OF ELECTRIC SHOCK INJURY

(For Use with Transparencies 1-22 or Slides 1-59)

SLIDE 1 *(TRANSPARENCY 1)*

Today we truly live in a world of wonders where we have a convenient servant many times more powerful than any fairy tale magician. This servant is electricity. It is also a friend that powers lights, appliances, and modern kitchens to make life easier and more meaningful. We now have available over 150 types of electrical appliances, and new ones are added to the list almost every day.

SLIDE 2 *(TRANSPARENCY 2)*

Through lack of understanding of the behavior and hazards of electricity, man often unknowingly may cause himself to become involved in injury-producing situations. But how great is the problem? About 1,000 persons are killed each year and many others are injured from misuse of electrical current. About 300 of these fatalities occur in the home. While the number of deaths due to electricity are few in comparison to other causes, many could be prevented. Headlines like those you see here often appear in hometown newspapers. These injuries need not occur because there are positive methods to prevent electric shock.

In addition to these injuries from electrical shock, an undetermined number of burn injuries and deaths result from the nearly 140,000 annual fires caused by faulty electrical appliances, wiring, and other equipment. Remember, an electrical shock hazard and an electrical fire hazard may be identical. Our discussion today, however, will cover primarily the prevention of electric shock injuries.

SLIDE 3 *(TRANSPARENCY 3)*

Almost everyone has experienced an electrical shock...haven't you? But have you wondered why you were only annoyed or startled, while others apparently under similar conditions were seriously injured or killed?

SLIDE 4

To seek an answer to these questions, let's learn some shocking facts about electricity.

Preceding page blank

SLIDE 5 *(TRANSPARENCY 4)*

Undoubtedly, while driving along the highway you have noticed electrical transformer stations such as this. What's missing?

SLIDE 6

On the high protective fence you will almost always find a sign which reads: DANGER - HIGH VOLTAGE - KEEP OUT. The sign means exactly what it says. But does this give you the impression that voltage alone defines the extent of the hazard? It shouldn't.

SLIDE 7 *(TRANSPARENCY 5)*

Let's go to a more familiar environment - the living room of your house. Here's the comfortable chair in which you sit while leisurely reading your favorite book. And here's the lamp that changes night into day - after the lamp cord has been plugged into a most welcome sight in any modern home - an electrical outlet. This outlet brings into your home 120 volt, 60 cycle alternating household current. But because of more exposure and perhaps less respect for electricity in the home, more deaths result from these household electrical circuits than from high voltage circuits used by electric utilities and industry.

SLIDE 8

In our homes should we also have a sign by each outlet reading ''Extreme Danger - Household Voltage''? This is certainly not necessary, but the term household voltage implies low hazard.

SLIDE 9

Household voltage and lower voltages do not mean low hazard.

SLIDE 10

It's the electric current that produces the shock hazard and may be lethal when the body is in circuit. Current depends upon the voltage and resistance; the more voltage, the more current; the more resistance, the less current.

SLIDE 11 *(TRANSPARENCY 6)*

So that we may speak the same language, let's review some familiar electrical terms.

SLIDE 12

Volts.

SLIDE 13

The number of volts tells how much pressure is behind the flow of electrical current. We're all familiar with the 1½-volt flashlight battery,

the 9-volt transistor radio battery, the 12-volt car battery, and the 120-volt electrical system in our homes. These numbers describe electrical energy under varying amounts of pressure.

SLIDE 14

Current is the amount of electricity moving through a circuit.

SLIDE 15

It is measured in amperes.

SLIDE 16

In any circuit there is opposition to the flow of current. It is called "resistance."

SLIDE 17

Resistance is measured in ohms.

SLIDE 18

Many items, especially copper, iron, and aluminum offer very little resistance to current flow. They are called conductors. Other good conductors include moist earth and water.

SLIDE 19

On the other hand, substances like rubber, glass, plastic, and dry wood offer a lot of resistance to the flow of electrical current. Because of this they are normally poor conductors and are called insulators. But many of these items which normally resist current flow may become conductors when wet.

SLIDE 20 *(TRANSPARENCY 7)*

The resistance of skin to electric current varies.

SLIDE 21

The resistance of the skin varies somewhere between the low resistance of a conductor of electricity, to the high resistance of ordinary rubber, an insulator. Much of the body resistance to current flow is in the skin. When the skin is dry, the body offers a considerable amount of resistance to current flow. But when you perspire or your body is exposed to moisture or you have a cut, you become much more like the copper wire, a good conductor of electrical current. The resistance of the skin not only varies from moment to moment but from person to person. Therefore, we cannot rely upon it to offer protection against electrical shock.

SLIDE 22 *(TRANSPARENCY 8)*

The amount of electrical current that can cause injury or death is so small that it is not measured in whole amperes, but in thousandths of one ampere. An ampere is the unit of measurement used to describe the flow of electricity through a given conductor. If we were talking of water in motion we would use gallons per second.

SLIDE 23

The amount of current required to light a pilot light on a percolator or hi-fi is about 1/1000 to 3/1000 of the one ampere, and when flowing through the body this minute amount can be detected by the average person. This causes the tingling sensation that in itself is harmless, but may startle you and cause you to fall, and thus increase the possibility of your having an accident and being injured.

SLIDE 24

If the current required to light a small Christmas tree bulb - about 15/100 of one ampere - should pass through the body, the muscles would contract. A person holding a wire or appliance leaking that much current would be unable to let go.

SLIDE 25

And if the amount of current required to light a 15-watt bulb, which is only 1/10 of an ampere, should flow through the heart, death might result in 1 second.

SLIDE 26 *(TRANSPARENCY 9)*

Let's review those factors that determine the severity of the electrical shock.

SLIDE 27

First, the amount or quantity of electrical current. Whether you are only startled or receive a fatal shock is determined by the amount of electrical current that passes through the body.

SLIDE 28

The path of the current through the body is very critical. If it travels from a faulty appliance through a non-vital area such as hand to elbow it may cause local injury due to heat effects severe enough to necessitate amputation. If it travels from hand to foot or hand to hand it may pass through vital centers (the heart, the lungs, the brain) of the body. Personal injury or death may result.

SLIDE 29 *(TRANSPARENCY 10)*

What other factors should we consider?

SLIDE 30

Length of time that the body is in the circuit is critical - it's measured in fractions of a second - not in minutes.

SLIDE 31

Skin characteristics - a cut, scratch, or moist skin can reduce the chief body protection against household current. Since the resistance of your skin can vary from minute to minute due to such changes in conductivity, we cannot depend on it as a protective device.

SLIDE 32

Area of contact - a small body contact area increases the resistance, whereas, with increased body contact, the body resistance decreases. Therefore, a larger amount of current can flow.

SLIDE 33 *(TRANSPARENCY 11)*

Electrical current can cause injury or death in three ways.

SLIDE 34

First, the flow of electric current through the body can cause serious burns both internally and externally. It frequently damages internal organs causing them to malfunction. Electrical burns by their very nature can be very deep, thus producing a painful, slow-to-heal injury.

SLIDE 35

Secondly, electrical current can interrupt the breathing process by blocking your nervous system. If your body is deprived of oxygen for more than a few minutes, death will result.

Paralysis is more likely to result when a body comes in contact with higher voltage current than that encountered in the home. Since high voltage current can affect breathing without affecting the heart, the prompt application of artificial respiration increases the victim's chance for survival.

SLIDE 36

Thirdly, current flowing through the heart area may disrupt the normal beat of the heart and bring on ventricular fibrillation, a condition where the heart quivers. Your heart normally beats as a rhythm pump 68-72 times per minute. Thus the regular pumping action of the heart ceases and death may result within a few minutes.

There is a special device, called a defibrillator, available in some medical facilities, capable of causing the uncoordinated twitching of the heart's muscles to cease, aiding normal heart action to resume. But it must be used in a very short time after the shock.

Generally speaking, in an electrical system such as we have in the home, there is more danger of receiving those *small* amounts of current which are more likely to cause fibrillation. Since an untrained person is not capable of detecting whether the heart is in fibrillation, always administer artificial respiration if the person is unconscious and appears not to be breathing.

SLIDE 37 *(TRANSPARENCY 12)*

Current is measured in amperes. The average household electrical system has a capacity of about 60 to 100 amperes. From this service equipment you will find a number of individual circuits which can safely deliver 15, 20, or perhaps 30 amperes of electricity. On these circuits we may have a number of appliances using whole amperes of electricity. The difference between the smallest amount of current you can feel and death may be as small as the difference between 1/1000 and 1/10 of just one of the many amperes your home electrical system is capable of carrying. The potential is certainly there.

SLIDE 38 *(TRANSPARENCY 13)*

Let's consider one more term called ''grounding''; we must understand it before we can understand both the cause and the prevention of electric shock.

For our purpose, ''grounding'' exists if: anything capable of carrying electricity touches the earth, or conductive material is directly or indirectly connected to the earth. Earth itself is considered to be grounded.

Most electrical systems are intentionally grounded. For example: a wire from a generator is connected to earth likewise, a wire from each of the transformers along the powerlines enters the earth. In the house this same wire, after entering the service box, is directly or indirectly in contact with the earth.

There are other items in our house which are good conductors of electricity and make contact with earth; for example, the cold-water pipe to the sink, lavatory, bath tub, stool, washing machine, radiator, and even the gas pipes, heating and air conditioning ducts. And don't forget the terrazzo or concrete floor. Since these items are in contact with the earth they are referred to as being grounded.

SLIDE 39 *(TRANSPARENCY 14)*

Electrical shock may occur when the body accidentally becomes a part of an electrical circuit. While each body conducts electricity differently, there is much we can do to reduce the likelihood of electric shock. Two recognized means of preventing electric shock injury are (1) insulation and (2) grounding of electrical appliances. Let's consider insulation first.

SLIDE 40

When selecting electrical appliances, always be certain that the product carries the Underwriters' Laboratory label. This label indicates that the product was designed to be adequately and reliably safe against electric shock injuries as well as electrical fire hazards. However, the UL label is no guarantee that a tool that was ''electrically safe'' one day may not through misuse or wear become defective and unsafe. It is well to point out that the UL label on the appliance cord or plug does not necessarily apply to the appliance itself. The appliance should also bear a UL label.

SLIDE 41

Many accidents are caused by failure to properly maintain electrical equipment. Replace flexible cords when they become frayed or show exposed wiring. This is safer than taping or splicing the cord. Avoid exposing electrical wiring and appliance cords to places where they may receive excessive wear.

SLIDE 42

Read and follow manufacturers' recommendations. Use this product only as intended by the manufacturer. For example, never subject electrical equipment to water or other liquids unless they were specifically designed for immersion. Also, prolonged use or overloading can cause insulation failure unless equipment is designed and rated for such use.

Do not use electrical appliances while your body is in contact with water or otherwise grounded. For example, do not use an electric hairdryer while bathing, doing the dishes or laundry.

All electrical motors should be periodically cleaned and oiled according to the manufacturers' recommendations. Remember that carbon particles and dirt may create a current path to external metal parts. Also, be sure to clean out ventilation openings to prevent overheating, which can accelerate aging of insulation and increase the possibility of insulation failure.

SLIDE 43

In certain quality portable tools ''double insulation'' is used to prevent shock. In addition to the normal insulation of the motor and wires, a ''double insulated'' power tool has its housing or housing interior made of a nonconductive material similar to plastic so no electricity can reach the user. Double insulation minimizes the ever-present danger of shock from ungrounded portable tools due to failure of the tool's regular insulation. Portable equipment having double insulation is so marked.

SLIDE 44 *(TRANSPARENCY 15)*

The second means of preventing electric shock is through proper grounding of electrical equipment. We have discussed the intentional grounding

of your electrical "system," which protects your electrical system and power equipment but offers only partial protection to you, the user.

Protection for the user is accomplished by adding a special third wire to the normal two wires in each appliance cord. When insulation in electrical equipment breaks down, wires become loose and if dirt or moisture is present, a current path can be set up to other parts of the equipment. Thus the metal exterior of the appliance or tool may become energized or charged.

SLIDE 45

The electricity having escaped its normal bounds can follow any conductive path back to earth. That path can be the human body.

A third wire, called a grounding conductor can prevent shock. This wire, when attached to the frame and properly connected to a *grounded* outlet will allow the dangerous electricity on the enclosure to travel safely to earth rather than through your body. It will also activate the fuse or circuit breaker, which is a protective device indicating that the equipment is "electrically unsafe." It is through this arrangement that a grounding wire can help prevent injuries.

SLIDE 46 *(TRANSPARENCY 16)*

How can you be certain that a wall outlet is properly wired to provide a positive ground? This can be done by testing for outlet ground. An inexpensive circuit tester available at most hardware stores can be used to determine if an outlet is grounded. The procedure for testing a two-hole outlet for grounding is this:

SLIDE 47

While holding the *insulated* portion of one prong of the circuit tester, touch the prong to the screw holding the wall plate on the outlet. If the screw is painted, remove enough paint to ensure a good electrical contact. Run the test by inserting the other prong alternately in the two holes in the outlet. If the tester lights in either case, the outlet is grounded. (Note: Caution against touching metal prong of circuit tester.)

SLIDE 48

If you are running a test on a three-hole wall receptacle the prong is first placed in the third hole instead of touched to the center screw. Again, if the tester lights in either position, the circuit is grounded. If the test light does not glow, call your electrical contractor or electrician to correct the situation.

SLIDE 49 *(TRANSPARENCY 17)*

You may ask the question - How can electrical equipment be grounded through a grounded electrical outlet box so as to prevent injury if the equipment should become "electrically unsafe"?

SLIDE 50

You will recall from our earlier discussion that good quality portable tools are equipped with a three-conductor cable containing a grounding wire or they are marked as having double insulation. In these tools the green grounding wire is molded right in the appliance cord and then connected inside the case to the frame of the tool.

SLIDE 51

If your electrical equipment has a three-prong plug it will fit directly into the latest type of three-hole grounded receptacles. Because the grounding prong is the longest of the three blades, the equipment is grounded before becoming energized.

SLIDE 52

A power tool with a three-prong plug can be grounded to a two-prong grounded outlet box by using an adapter. Grounding in this case is accomplished by first connecting the wire - known as a pigtail - extending from the adapter securely to the metal screw holding the face plate of a grounded outlet.

SLIDE 53

With older equipment, grounding is accomplished by attaching the pigtail wire to the metal screw holding the faceplate to a grounded outlet.

SLIDE 54 *(TRANSPARENCY 18)*

We've been speaking of grounding procedures with portable electrical equipment. Are there different procedures for stationary electrical equipment? Some equipment such as washing machines, refrigerators, home freezers, and other may not be equipped with a three-wire power cord for easy grounding. Grounding the metal enclosure of the equipment is of prime importance, because many of these appliances may be in use in basements and on cement floors where the floor is apt to be moist or a person using the equipment can be in contact with the wet soil or with metal objects that are themselves grounded.

An electrician, after determining that the water pipe or the outlet is properly grounded, may securely attach a copper wire (not less than No. 18 which is lamp-cord size) to the unpainted portion of the metal frame of the appliance. Using a metal clamp, he may secure the other end of the wire to the metallic water pipe, preferably where it enters the house, or he may attach it to a grounded outlet box.

Some appliances that require 240 volts, such as electric stoves, electric clothes dryers, electric water heaters and some air conditioners, use a special three-prong plug. These electrical appliances are usually properly grounded, but if there is any question a qualified electrician should be consulted. Most areas have an electrical inspector who makes sure that electrical installations in homes meet the minimum safety standards of the National Electrical Code. He has authority to approve

electrical appliances for installation. He almost always will approve installations using appliances listed by the Underwriters' Laboratory.

SLIDE 55 *(TRANSPARENCY 19)*

Does this discussion on grounding mean that every electrical device should be grounded? Certainly not. You should never ground an appliance that has an accessible open-coil heating element, such as a radiant heater, some broilers, and a toaster. Here's why.

SLIDE 56

If you should touch the operating heating element of a toaster with a knife or other electrical conductor and, at the same time, touch a part of your body to the outer metal shell which is grounded, your body completes a circuit and current can flow. This is dangerous. A person should never attempt to dislodge and remove material from a toaster with a metal instrument without first disconnecting the toaster at the outlet receptacle.

Conversely, what equipment should you ground? *All* electrical equipment should be grounded except that with exposed heating elements. It is especially important to ground portable tools and electrical equipment used in a garage, basement, on the lawn or patio or any place where you stand on a concrete floor or are near grounded objects such as water pipes, metal ducts, etc.

SLIDE 57 *(TRANSPARENCY 20)*

Electric shock injuries can be prevented. We know what causes them and what we must do to prevent them. Since prevention is everyone's personal responsibility, let's briefly review the newsclippings to see what action could have prevented these tragic injuries and deaths.

SLIDE 58 *(TRANSPARENCY 21)*

It is our hope that this better understanding of electricity, together with proper installation and maintenance of electrical equipment, will enable you to safely enjoy the benefits of this faithful, powerful servant.

SLIDE 59 *(TRANSPARENCY 22)*

Produced in the interest of preventing injuries.

by

Injury Control Program
U.S. Public Health Service

Script II

DEMONSTRATION ON PREVENTION OF ELECTRIC SHOCK INJURY

(For use with electric shock injury transparences, numbers 1-12, and demonstration house.)

1. Furthering our Understanding of Electricity.

Indicate circular motion with pointer.

To further our understanding of electricity, let us build upon the knowledge we have. We know that somewhere in the distance a generator turns, converting mechanical energy into electrical energy.

Indicate push or movement with hand.

The electricity flows from the generator to a transforming station nearby where the voltage or pressure behind the flow of electrical current is increased to perhaps hundreds of thousands of volts. This is done primarily for ease and economy of transmission.

From the transforming station, the electricity flows under tremendous pressure at the speed of light, 186,000 miles per second, over miles of transmission lines to your city.

Point to pole in back and then to front pole.

In the process of coming into your city and neighborhood, the electrical current again goes through transformers. This time, the voltage or pressure is reduced so that it will be compatible with your household electrical equipment and wiring system.

Follow service lines into service box and house.

From the familiar cylindrical transformer that may be found on an electrical power pole in your neighborhood will flow 120-volt and 240-volt electrical current, which travels into your service box and to all parts of your house for you to use. How you use it is up to you.

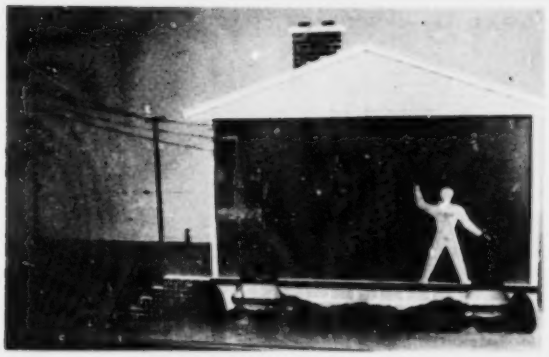
Place man against backdrop of house.

Point to self.

This is a nearly perfect system - that is, until man comes upon the scene. We should not blame electricity or the environment for the hazards. More often it is people's management of electricity that presents the real problem.

2. Meaning of "Grounding."

Before beginning the demonstration, there is one more term we must understand before we can learn the cause of electric shock injuries and how to prevent them.



Hit pointer on floor indicating in touch with earth.

The word is ''ground'' or ''grounding.'' For our purpose, a ground or grounding exists in the earth itself, which is considered grounded, or when anything capable of carrying electrical current touches the earth or is indirectly in contact with the earth through another conductive material.

Point to self.

We know that most metallic items, earth, and water are good conductors of electricity, but is it not a shame that the human body also is included?

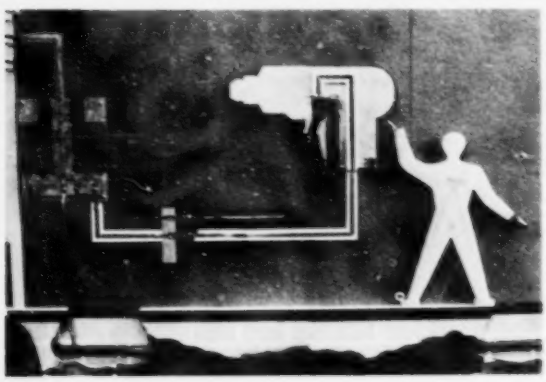
Follow center wire (ground) into box, and to water pipe.

Most electrical systems are intentionally grounded. For example, a wire from the generator is connected to the earth, and a wire grounds each transformer along the power lines. In the house, this same wire after entering the service box is put indirectly in contact with the earth by clamping to the water pipe, which itself is in contact with the grounded earth.

Point to electrical wires inside house.

This method is called a "system ground." Its purpose is to protect your electrical system and equipment, but it offers only partial protection to you. Later we shall discuss how personal protection is made possible by a second type of ground called "equipment ground."

3. Our Electrical System and Appliances.



Pick up "oversized" wall outlet.

Perhaps the most useful item in our household electrical system is a wall outlet, which enables us to operate dozens of portable appliances that make life easier.

View outlets from front and then from side.

Instead of viewing an outlet from the front as we normally do, let us view a working model from the side, so that we can follow the continuity of the wires entering the outlet box.

Secure "house" wall outlet to house.

We now attach the working model of the wall outlet to the house.

Show hand tool.

Without portable appliances, wall

outlets may be useless. This working replica of a portable hand tool represents many of the 150 types of appliances now on the market.

Point to wall outlet and then to hand tool. Secure two-wire appliance cord to house.

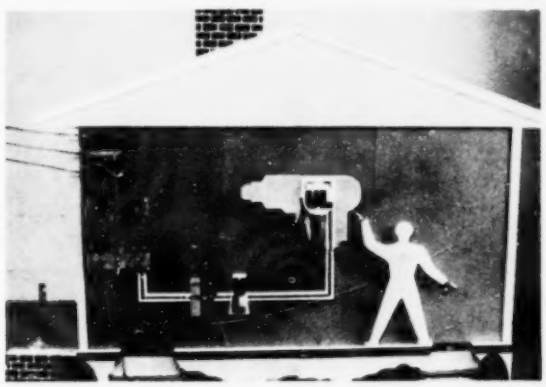
From the wall outlet to the appliance, we attach a two-wire appliance cord that is commonly found on many older appliances, as well as on certain appliances currently on the market.

Point to black insulated wire. Follow to motor, white ground wire, and to service box.

When I close the switch, electricity flows from the ''hot'' black insulated wire, through the motor, and through the white insulated grounded conductor to the service box. From there, it returns to earth through the water pipes, making a complete circuit.

Follow wire from service box to water pipe.

4. Underwriters' Laboratories Label.



Place UL label on drill.

When purchasing electrical equipment always look for the Underwriters' Laboratories (UL) label. This tells you that the item has met minimum safety standards, and

it is your assurance that this equipment has been designed to be relatively free from fire and electrical shock hazards. Meeting minimum safety standards, however, does not necessarily determine the degree of safety or quality for that item. For example, many inexpensive and little-known brands of portable equipment bearing the UL label are sold in a wide variety of stores.

The integrity of the manufacturer, which often will determine the degree of quality and the safety features built into an electrical item, should always be considered, as well as the UL label.

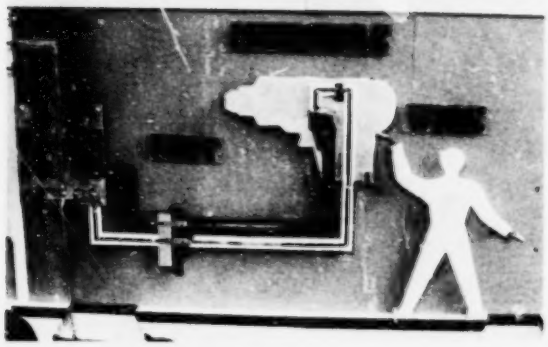
Point to UL label.

Place UL label on appliance cord.

The UL label is no guarantee that a tool that was ''electrically safe'' when purchased may not, through misuse or normal wear, become defective and electrically unsafe later. *It might be well to point out that the UL label on the appliance cord or plug does not necessarily apply to the appliance itself. The appliance also should bear a UL label.* Look for it - it is your protection.

5. Proper Use and Maintenance of Electrical Equipment.

Many accidents are caused by failure to properly use and maintain electrical equipment. Read and follow the manufacturers' recommendations. Use the product only



Secure ''moisture'' sign to house.

as he intended. For example, never subject electrical equipment to water or other liquids unless it is specifically designed for immersion, for moisture can set up a current path to exterior parts. Unlike your electrically unsafe appliance, our demonstration frame glows to indicate when it is defective. Notice that it still functions properly.

To those of us working in injury control, it seems that people are unconsciously seeking new ways to become a ''part'' of an electrical circuit. For example, the busy college student or housewife, to save time, often plugs a hairdryer to an outlet, then attaches the hairdryer to her head and keeps it in operation while bathing, washing dishes, or doing the laundry. Because the body is grounded under these circumstances, an ''electrically unsafe'' appliance or cord could cause injury or death.

Point to hand tool.

Electrical motors should be kept clean and periodically oiled as

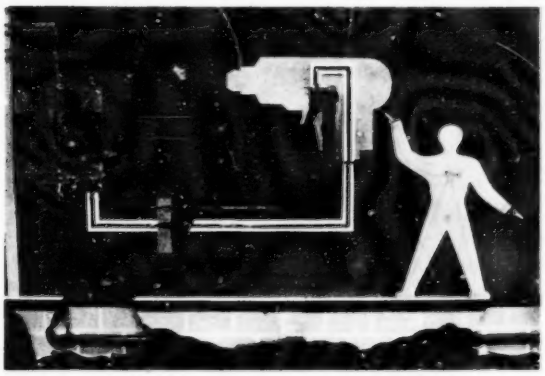
Secure ''dirt'' sign to house.

recommended by the manufacturer. Remember that carbon particles and dirt can set up current paths to exterior conductive parts.

Secure ''wire'' sign to house.

Also, avoid ''overloading'' the equipment, which can cause accelerated aging of the insulation. ''Overloading'' thereby increases the possibility of insulation failure, resulting in a wire contacting the metal frame.

6. Electrically Unsafe Equipment and You.

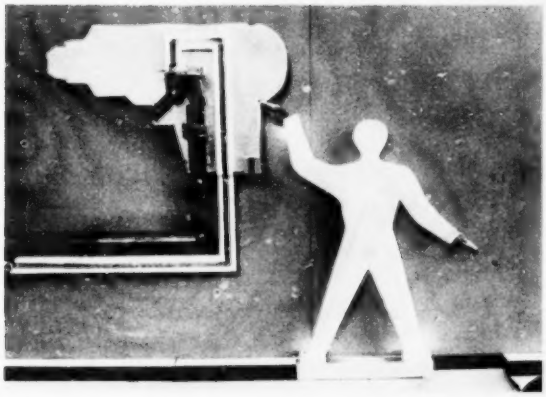


Place plastic man's hand to edge of hand tool. Point to two-wire cord and glowing outer edge of hand tool.

You may have in your home several portable appliances with two-wire cords that are ''electrically unsafe,'' and the user may never know it. Why? Because ''electrically unsafe'' equipment, unfortunately, continues to function properly.

Indicate that nothing is around the tool to touch.

When this equipment is used in an environment such as a living room or bedroom, where it is not practical to touch the shock hazard and the ground at the same time, no shock will occur.



Place ''grounded'' metal strip under the man.

Follow circuit through body.

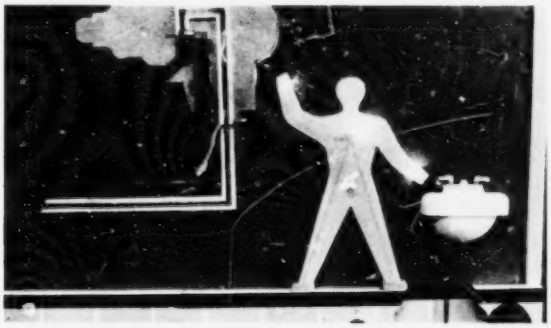
If the same equipment is used out of doors, in the basement, or in the presence of other grounded items, then touching the defective appliance and a grounded floor, simultaneously, will complete the circuit necessary for current to flow into and out of the body.

Remove the ''grounded'' metal strip. Place a few drops of liquid into channel.

Secure lavatory to house.

A dry wooden floor normally is not a conductor of electricity. But when it gets wet, it is possible that, in the presence of an unsafe tool, a circuit to the ground through your body may be completed.

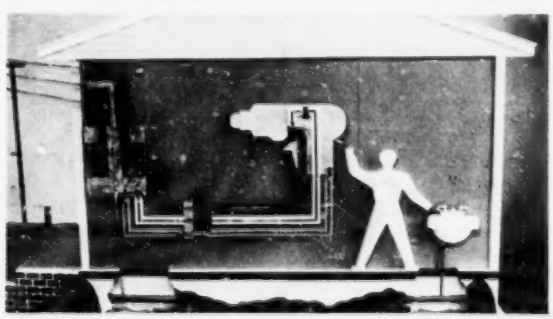
We have been illustrating the dangerous flow of current from



Complete circuit from hand to hand of man.

one hand, possibly through the heart and lungs, and out through the feet. But, in our homes, a number of items capable of carrying electricity are in contact with the earth through water pipes. This sink can represent items such as the lavatory, laundry tub, shower, bath tub, and stool. We must remember that gas pipes and the heating and air-conditioning ducts also are grounded. The basic point of our discussion is this: If we touch electrically unsafe equipment and a ground at the same time, a circuit will be completed, allowing current to flow from arm to arm through vital parts of the body.

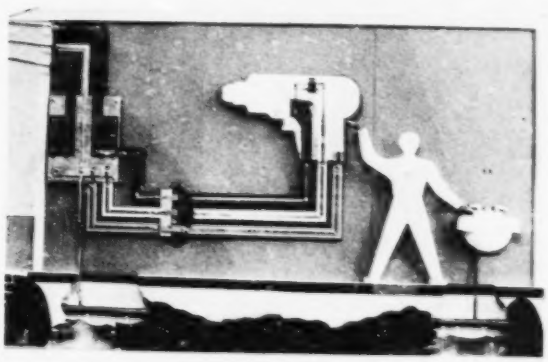
7. Personal Protection Through Equipment Ground.



Point to red rim of hand tool - remove ''short.''

What can be done to protect us from possible shock when we unknowingly use electrically unsafe equipment? Personal protection from electrical shock is accomplished by combining a third wire called a ''grounding conductor'' to the normal two wires of each appliance cord. This third wire will not be effective, however, unless properly connected to a grounded wall outlet containing a third wire or other suitable ground.

Secure third wire to wall outlet.



Point to third wire and grounded man.

When we use a properly grounded appliance, no shock will occur, even when touching a ground, because the stray current on the frame will travel safely to ea through the third wire rather th through your body. In this case, electricity travels the easiest path back to earth through the third wire, and it will flow in such quantity that it will cause a fuse to blow or the circuit breaker to trip. This indicates that the equipment is ''electrically unsafe.'' Under no circumstances

Place short on other side of switch - turn on switch, and point to blown fuse.

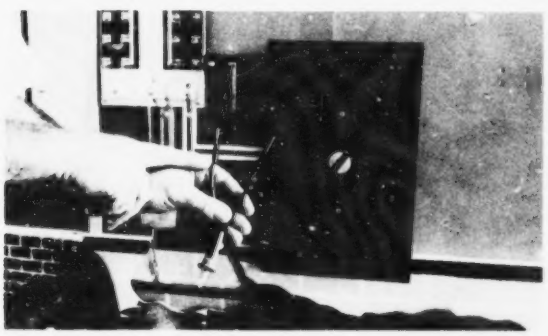
should it again be used until the defect has been properly corrected.

One of the newer injury prevention ideas incorporated into certain quality tools is ''double insulation.'' A ''double insulated'' tool has the normal insulation of the motor and wires and, in addition, the interior of the enclosure or the enclosure itself is made of a nonconductive material similar to plastic so that any electricity escaping the normal bounds will not reach the user. Portable tools having ''double insulation'' are so marked and should bear the UL label.

8. Checking an Outlet for Ground.

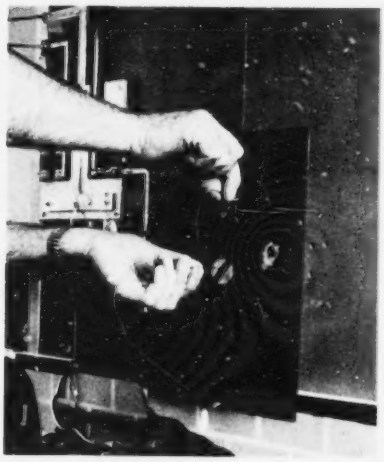
Attach ''oversized'' wall outlet to house.

How can you be certain that a two-hole or three-hole wall outlet is properly wired to provide a positive ground so that the current will flow safely back to earth when the equipment becomes unsafe?



Hold up circuit tester designed for 120 volt system.

An inexpensive circuit tester obtainable at most hardware stores can be used to determine whether an outlet is grounded.



Using 12 volt circuit tester, place one prong of tester to screw.

The procedure for checking a two-hole wall outlet is to grip only the *insulated* portion of one prong of the tester and place it against the screw holding the wall plate in place. If the head of the screw is painted, remove enough paint to make electrical contact.

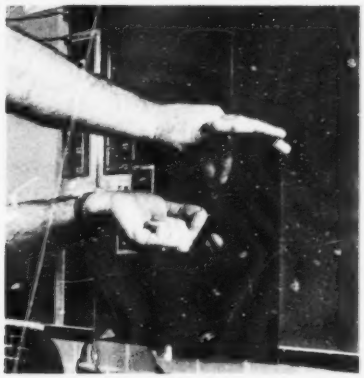
Insert other prong in one hole, and then in the other.

Then, while gripping the insulated portion of the other prong, insert it alternately in one hole and then in the other of the two-hole outlet. If the tester lights in either position, the wall outlet is grounded. If the screw and wall plate are nonconductive (plastic), grounding cannot be determined in this manner.

Place one prong in the center hole and the other prong in one hole (first) and then the other.

In the three-hole wall outlet, the third hole is used instead of the screw. Again, if the tester lights in either position, the outlet is grounded.

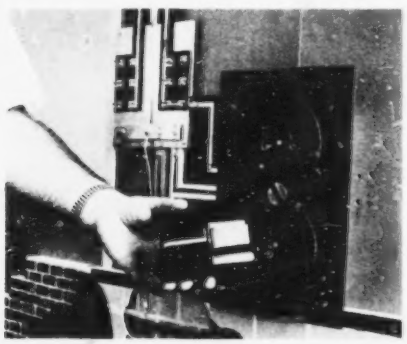
Consult your electrical contractor or electrician if the outlet



should be grounded, and the test light shows that it is not.

9. Grounding of Portable Appliances.

How can you ground portable electrical equipment to a grounded outlet box in order to prevent injury?



Point to three-prong plug.

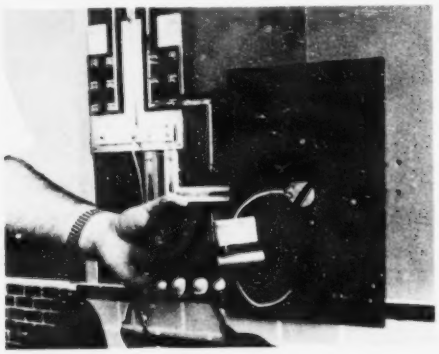
Good quality portable tools are equipped with a three-conductor cable and a three-prong plug, or are marked as having "double insulation." If your portable equipment has the three-prong plug, it will fit directly into the latest type of three-hole grounded wall outlet. Because the grounding blade is the longest of

Insert three-prong plug in oversized three-hole outlet.

Remove from outlet to show grounding blade.

the three blades, you are assured that the equipment is grounded before it becomes energized, not afterwards.

Remove three-hole outlet and insert two-hole outlet.



Pick up adapter.

Insert adapter into the two-hole outlet.

Insert clip under screw to face plate.

Equipment with a three-prong plug can also be grounded to a two-hole *grounded* wall outlet by using an adaptor plug which is inserted in the two-hole wall outlet. The terminal or the ''pig tail'' of the adapter is fastened under the screw holding the outlet face plate in place.

Insert three-prong plug into adapter.

The three-prong plug can now be inserted into the adapter, and the equipment will be automatically grounded.

10. Equipment Not in Use Can Be a Hazard.

Secure toaster and appliance cord to house before starting.

Point to top switch in ''off'' position.

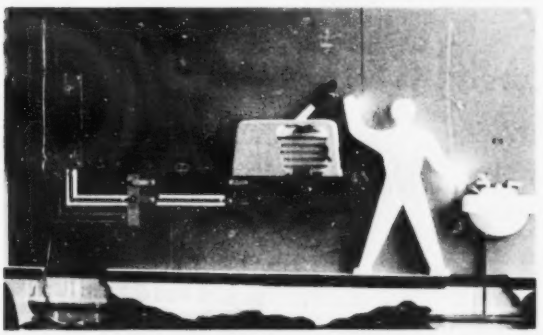
All fixed or portable electrical equipment can present a shock hazard when connected to an energized circuit, even when the equipment is shut off. You should not rely upon the fact that the equipment is not in use, or that the switch is ''off,'' when changing broken light bulbs, repairing

electrical equipment, or removing a piece of toast lodged in a toaster.

Point to single pole switch.

Close top switch.

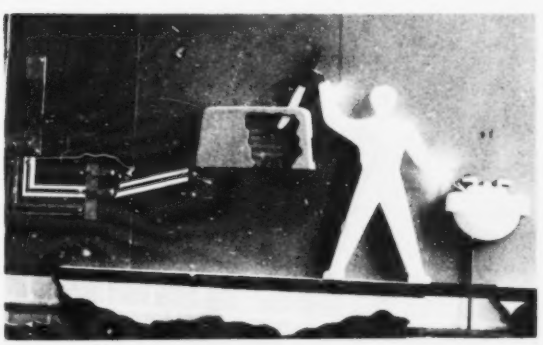
Most appliances have a "single-pole switch" that breaks the electrical circuit by disconnecting only one wire. When the switch is closed, the appliance will operate.



Hold up knife.

In applying this knowledge, we can see that we should never attempt to dislodge a piece of toast with a metal instrument, such as a knife, without first disconnecting the appliance cord at the wall outlet. Otherwise, a shock or burn hazard is possible, especially, if you simultaneously touch a ground and the heating element while the toaster is in use.

Turn switch on, place knife in hand of man whose other hand is on sink. Remove knife from toaster. Exchange appliance cord for crossed cord. (Note: location of knife in toaster with parallel and crossed appliance cord is important.)



With switch ''off,'' touch knife in man's hand to the contact on your right.

A hazard may exist even when the toaster is not in operation if there is the right combination of a single-pole switch and a two-prong plug inserted in a certain way.

Remove appliance cord.

Because of the possibility of exposure to live wires and heating elements, you always should disconnect the appliance from the outlet. In a fixed circuit, such as a light circuit, it is safer to remove the fuse, or trip the circuit breaker, before making any contact with the internal wiring or elements.

To prevent shock, it is necessary to ground *most* electrical equipment, with the exception of items having accessible open-coil heating elements, such as toasters, some broilers, and radiant heaters. In these, grounding increases the hazard. It is advisable to ground all electric *portable tools* wherever they are used.

11. Shock Hazards Outside House.

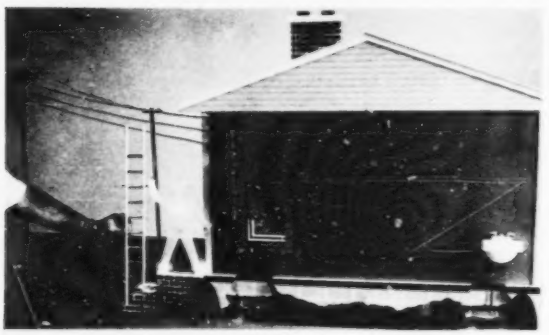
Place man on steps.

Most of us are typical do-it-yourself enthusiasts. We install our own television antennae, prune our own trees, paint our own houses, and engage in dozens of other home projects.

Point to power lines into house.

To do many of these things, a ladder is essential. Today, ladders that are most durable and

light weight are made of aluminum and other alloys that are excellent conductors of electrical current when in contact with one or more wires of any power line.

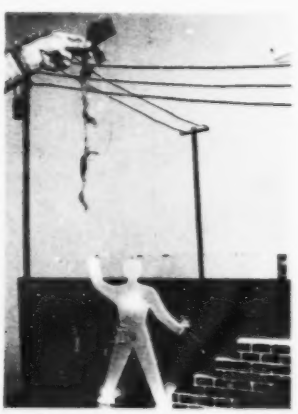


Place ladder in man's hand. Move ladder into power line.

Too often, a tragic experience results when a person accidentally contacts a power line while installing a television antennae, carrying a ladder, or painting his house. The results are often fatal.

Place kite in man's hand.

In the spring, young boys and girls may turn to flying kites. Parents also, often find it a rewarding experience. Our discussion on ''grounding'' points out why kites should not be flown near power lines.



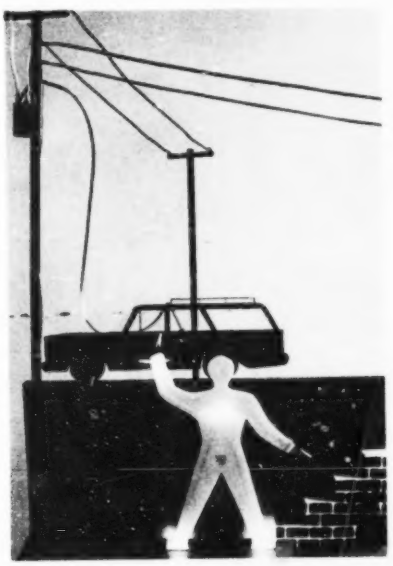
Bring kite string against top wire.

Under normal conditions, a cotton kite string is a poor conductor of electricity. But when it is moist, or if it contains metallic threads, it will easily conduct electricity into the hands of the person flying the kite. Flying kites is fun and is wholesome exercise, but do it safely, away from power lines.

Remove kite. Place car on ground profile on left side of house.

Remove bottom power line from house and place on car.

Joy riding in an automobile is another great American pastime, but hundreds of automobile accidents occur each day. Occasionally, an electric power pole is broken during these mishaps, causing a power line to fall onto, or near, the vehicle.



If an electrically charged wire falls on the car, unless there is immediate danger of fire, *it is much safer to remain inside* until the power line is de-energized or is safely removed from the car.

Point out current path through grounded man touching car.

If it becomes necessary to get out of the car in an emergency, open the door as wide as possible and jump without touching the car and the earth at the same time.

This same principle holds true if we rush to assist at the scene of an accident where a wire may be in contact with the car. A serious burn, or even death, may result from neglecting to notice the presence of such a wire. It should be removed or de-energized by power company linemen before an attempt is made to aid the person inside.

This better understanding of electricity, together with proper installation and maintenance of electrical equipment, will enable you to safely enjoy this faithful, powerful servant.

PROGRAM AIDS AND MATERIALS

A. *TECHNICAL REPORTS*

Electrical Injuries. Brown, K. L., and Moritz, A. R. Journal of Trauma, Vol. 4, 1964, pp. 608-617.

Effect of Electric Shock on the Heart. Ferris, L. P., King, B. G., Spence, P. W., and Williams, H. B. Electrical Engineering, Vol. 55, 1936, pp. 498-515.

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Post-Electroshock Syndrome. LaJoie, R. J. (M.D.) Industrial Medicine and Surgery, 31(8), August, 1962, pp. 354-359.

Myocardial Changes after Direct Current Electroshock. Sussman, R. M. (M.D.), Woldenbert, D. H. (M.D.), and Cohen, M. (M.D.). J.A.M.A., 189(10), September 7, 1964, pp. 739-742.

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B. *BOOKLETS*

Static Electricity in Hospital Operating Suites: Direct and Related Hazards and Pertinent Remedies. Guest, P. G., Sikora, V. W., and Lewis, B. U.S. Government Printing Office, Washington, D. C. 20402, 1953.

Electric Shock, Its Causes and Its Prevention. Kline, Lt. R. L., and Friauf, J. B. (Dr.). U.S. Government Printing Office, Washington, D. C. 20402. $0.20.

Portable Electric Power Tools - How to Use Them Safely. Division of Safety and Hygiene, The Industrial Commission of Ohio, Columbus, Ohio.

The ABC of Home Wiring. Kennecott Copper Corporation, 161 East 42nd St., New York, N. Y. 10017. Free.

Control of Electrical Shock Hazards. Homan, S. W., Griffin, W. G., and Gidel, R. D. U.S. Government Printing Office, Washington, D. C. 20402, Bulletin 216. $0.15.

Safety Standards. Ward, M. F. U.S. Government Printing Office, Washington, D. C. 20402. $0.15.

How to Keep Electricity from Killing You. Navships 250-660-78, Bureau of Ships, Navy Department, Washington, D. C. 20360.

Static Electricity. Bulletin #256, U.S. Government Printing Office, Washington, D. C. 20402. $0.15.

Your Guide to Safety from Electrical Hazards. Accident Prevention Department, Association of Casualty and Surety Companies, 110 William Street, New York, N. Y. 10038. Single copy free.

What Every Woman Should Know about Electricity - The ABC's of Electricity. Channing L. Befe Company, Greenfield, Massachusetts. Single copy, $0.25; 2 to 100 copies, $0.10 each.

What You Should Know about Electric Shock - at Home - at Work! 15 pages, Dray Publications, Deerfield, Massachusetts. 100 copies, $0.10.

Bright Ideas for Ladies. National Electrical Manufacturers Association, 155 East 44th Street, New York, N. Y. 10007. $0.15 for orders of 1-199 copies.

C. *LEAFLETS*

Electric Extension Cords. Industrial Data Sheet D-Gen. 21, National Safety Council, 425 North Michigan Avenue, Chicago, Ill. 60611.

Grounding of Portable Electric Equipment. Data Sheet D-Gen. 21, National Safety Council, 425 North Michigan Avenue, Chicago, Ill. 60611.

Low Voltage Extension Light Cords and Systems. Data Sheet D-Gen. 47, National Safety Council, 425 North Michigan Avenue, Chicago Ill. 60611.

It's So Easy to Be Safe With Electricity. Con Edison, 4 Irving Place, New York, N. Y. 10003.

Electrical Safety in Every Room. International Association of Electrical Inspectors, 612 North Michigan Avenue, Chicago, Ill. 60611.

Safe Grounding of Electrical Equipment. Stock #699, 31-127, National Safety Council, 425 North Michigan Avenue, Chicago, Ill. 60611.

Attention ''Sea Hunters'' - ''Charged'' Water. Stock #1101, 31-3, National Safety Congress and Exhibition, Oct. 26-29, 1964, National Safety Council, 425 North Michigan Avenue, Chicago, Ill. 60611.

Give Your House a Wiring Checkup. National Safety Council, 425 North Michigan Avenue, Chicago, Ill. 60611. Single copies - free.

Safe Grounding of Electrical Equipment. Nat Safety Council, 425 North Michigan Avenue, Chicago, Ill. 60611.

Your Electrical Appliances. National Safety Council, 425 North Michigan Avenue, Chicago, Ill. 60611. $0.22; minimum order - 50.

Planning A Safe Farm Electrical System. National Safety Council, 425 North Michigan Avenue icago, Ill. 60611. $0.22; minimum order - 50.

Electrical Wiring. Circular Series, Index No. G 4.2, Small Homes Council, University of Illinois, Urbana, Ill. 61801. $0.15.

Facts About Electric Wiring. Copper Development Association, Inc., 405 Lexington Avenue, New York, N. Y. 10017.

D. ARTICLES

Are You Safe with Your Electric Plugs? Consumer Bulletin Vol. 47, pp. 17-18, August 1964.

A New Electrical Hazard - Defroster Devices for Refrigerators and Freezers. Consumer Bulletin, Vol. 47, pp. 9-11, May 1964.

Guarding Against Electric Shock - A Consumer's Union Reprint from the Buying Guide Issue. Consumer Reports, December 1963.

How to Use Power Tools Safely. Occupational Hazards, Vol. 28, pp. 60-62, April 1966.

Ground Appliances for Electrical Safety. Consumer Bulletin, Vol. 49, pp. 19-21, March 1966.

Danger, 110 Volts. Family Safety, Spring 1964, pp. 21-23.

Instruments for Determining Shock Hazards of Electrical Appliances. Consumer Bulletin, Vol. 48, pp. 37-40, August 1965.

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Electric Shock Can Kill. Tennessee Magazine, pp. 26-27, January 1965.

Can Electric Tools Now Be Shock Proof? Consumer Bulletin, Vol. 48, pp. 33-34, July 1965.

Is There an Electrician in the House? Family Safety, Winter 1965, pp. 26-27.

Electrical Appliances Can Be Dangerous. Safety Review, 22(1), pp. 10-11, January 1965.

E. FILMS AND SLIDE PRESENTATIONS

A Shocking Affair (16 mm, black and white or color, 2 min., 1953). A cartoon which illustrates the safety rule: "Never touch plumbing and electrical fixtures at the same time." Purchase or rent film from Stout State College, Audio-Visual Center, Menomonie, Wis. 54751.

This Will Kill You (35 mm, strip with sound, color, 30 min., 1952). An award winning film, covering the basics of electrical hazards. For general audience. Purchase only from Triad Corp., 17136 Ventura Blvd., P. O. Box 648, Encino, California 91316.

A Split Second from Disaster (16 mm, color film, 14 min.). Public service film narrated by Chris Schenkl, produced by Miller Falls, to explain the shock hazards inherent in electric tools. It shows how these hazards can be avoided. To arrange for a showing, write to: Educational Film Dept., Miller Falls Co., Greenfield, Massachusetts 01301.

How To Stop Shock. A slide presentation for group training in accident prevention. National Safety Council, Stock no. 176-02-31. Showing time: 10 min. National Safety Council, 425 North Michigan Avenue, Chicago, Ill. 60611.

Electrical Safety In the Home (16 mm, color, 14½ min., 1960). Alerts viewers to common electrical hazards in their homes and depicts proper means of preventing or correcting such hazards. Purchase film from Stout State College, Audio-Visual Center, Menomonie, Wis. 54751.

Be Current-Wise (16 mm, color, 15 min.). A film for the general public with emphasis on high voltage hazards and how they can be avoided. Also discusses common electrical hazards and proper fusing in the home. Available on loan from the Employers Mutuals of Wausau, Film Department, Wausau, Wisconsin 55402.

Just Plug It In (16 mm, color, 24 min.). Illustrates safe practices using electrical home appliances and equipment. Bay State Film Productions, Inc., Box 129, Springfield, Massachusetts 01101.

Play It Safe (16 mm, color, black and white, 16 min.). Demonstrates safe use of home appliances, especially for Canadian audience. Query film source Ontario Hydro, 620 University Avenue, Toronto 2, Ontario, Canada.

Safety With Electricity (16 mm, black and white, color, 10 min.). Demonstrates that electricity can be dangerous and how to minimize dangers with simple safety precautions. Simple experiments and demonstrations show nature and sources of electricity and illustrate desirable practices with electric equipment. Rent or purchase from Encyclopedia Britannica Films, Inc., 1150 Wilmette Avenue, Wilmette, Illinois 60091.

F. FOLDERS AND STOCK ORDERS

Outdoor Electricity. Folder tells what you should know before you use electricity outdoors. Dray Publications, Inc., Deerfield, Massachusetts 01342. $0.09 each for orders of 1-499 folders.

About Electricity. Folder on avoiding electrical fires. National Fire Protection Association, 60 Batterymarch Street, Boston, Massachusetts 02110. $1.50 for 100 copies.

(For all of the following pamphlets, write to the National Safety Council, 425 Michigan Avenue, Chicago, Illinois 60611):

Program Guide for Electrical Safety. Stock number 699.31-130. Minimum order of 50 sheets is $0.025 each.

Electrical Equipment. Safety Education Data Sheet Number 429.04-9. Minimum order of 10 sheets is $0.068 each.

Safety for Amateur Electricians. Safety Education Data Sheet Number 429.04-78. Minimum order of 10 sheets is $0.068 each.

Home Workshops. Safety Education Data Sheet Number 429.04-41. Minimum order of 10 sheets is $0.068 each.

Safe Home Appliances. Stock number 511.1147. Single copies are available free from the Home Department.

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